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ABSTRACT

This study examined whether the use of trend analysis combined with analysis of persistence variables can be used to establish a model to forecast the first-year persistence of college freshmen. A linear model was created using data on 2,603 first-time freshmen at a moderate-sized comprehensive university from fall 1989 through fall 1993. The forecast equation was tested on the first-year persistence rate for freshmen newly enrolled in fall 1994. The resulting discrepancy was between the expected and actual persistence rate of 0.56%. The study identified the following variables as having statistically significant correlations with freshman first-year persistence: high school grade point average, high school rank, university grade point average, Scholastic Assessment Test (Math) score, loans, institutional scholarships, outside scholarships, and work-study. Five tables and a figure detail the study's findings. (Contains 12 references.) (Author/LEE)

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TREND ANALYSIS AND ENROLLMENT MANAGEMENT

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Jean Endo
Editor
AIR Forum Publications

Abstract

Trend Analysis and Enrollment Management

The purpose of the study is to determine whether the use of trend analysis combined with analysis of persistence variables can be used to establish a model to forecast freshmen first-year persistence. A linear model was created using data on first-time freshmen at a moderate-sized comprehensive institution from Fall 1989 through Fall 1993. The forecast equation was tested on the first-year persistence rate for freshmen newly enrolled in Fall 1994. The resulting discrepancy between the expected and actual persistence rate of 0.56%.

TREND ANALYSIS AND ENROLLMENT MANAGEMENT

Enrollment management continues to be important in higher education planning as institutions face the changing demographics of potentially larger freshman populations, while at the same time experiencing reduced state and federal financial support for student aid and capital investment. Enrollment management incorporates a number of elements such as marketing, recruitment, admissions activities, and retention programs (Hossler, 1984). However, no undergraduate enrollment plan is complete without enrollment projections of both new freshman and continuous students. One common method of enrollment projection for K-12 schools is the *survival ratio technique*, which establishes a ratio for students transitioning from one grade to the next. The survival ratio technique operates on the assumption that enrollment trends of a five-year period will be repeated in the future (Martin, 1991).

Enrollment managers have experimented with a number of projection models in higher education. The models incorporate such approaches as calculating seats taken and credit hours generated by discipline by semester (Weissman, 1994), tracking the number of transcript requests and the number of students submitting withdrawal or leaves of absences (Lonabocker and Halfond, 1984), and cohort-stripping where unique cohorts are subtracted from the aggregate projections for independent analysis (Kardonsky and Morishita, 1990). More complicated attempts to project enrollments include the cohort ratio and longitudinal persistence models (Tukey, 1991), fuzzy time series and neural network approaches (Song and Chissom, 1993), and the combination of a polynomial lag econometric model with a goal programming model (Rumpf, Coelen, and Creran, 1987). One of the more popular models is the Markov Chain, a tracking model that calculates a probability matrix based on one-year data (Donhart, 1995). The margin of error on all these models range from .67% to 9.3%, with the average margin of error being about 3%.

Most enrollment projection models are based on the assumption that factors which affect the enrollment environment will remain constant into the projected future. The models also do not provide reasons why students move in and out of an educational system. No model has combined the use of significant persistence variables with trend analysis in an attempt to better predict persistence and enrollments.

The most complex "class" of students to predict persistence are freshman because a greater variety of variables affect freshmen than upperclassmen. Financial aid and academic variables appear to take a heavier toll on freshmen than upperclassmen who have survived and compensated for the various inequities as they progress toward graduation (Murdock, 1987). Variables that affect one population of freshmen's persistence may not be significant to other populations. For instance, variables that affect women and various ethnic groups may not affect men or whites (Murdock, Mayer, Tsui, 1995). Therefore, determining more accurate methods to measure relationships among variables and freshmen persistence would enable institutions to better predict enrollments and, hence, better plan in its course offerings, facility's use, and residential life.

Purpose and Methodology

The purpose of this study is to determine whether the use of trend analysis when combined with the analysis of significant persistence variables can be used to establish a forecasting model for freshmen persistence. The study consisted of 2,603 first-time freshmen over a six-year period at a moderate-size comprehensive university from Fall 1989 to Fall 1994. A trend analysis was applied to examine the temporal relationship between the first-year persistence rate of first-time freshmen and various categorical factors such as campus residence, state residency, citizenship, ethnicity, college, and gender. In addition, the continuous academic variables of SAT, high school GPA and rank, university GPA along

with the continuous financial aid variables expressed as a percent of the types of financial aid of the total award were examined. Both the scales of the number of students and the percentages of total students were used in the analysis.

Results

High school GPA, high school rank, University GPA, SAT_Math, loans, institutional scholarships, outside scholarships, and workstudy had statistically significant correlations with freshmen's first-year persistence. However, academic and financial aid variables were not used in the trend analysis approach because of the complexity of converting continuous variables into categorical variables. Of the categorical variables, only campus residence had a statistically significant relationship with freshmen's first-year persistence (Table 1). In addition to the correlation test, a frequency test was applied to the same sets of variables. Results from the frequency tests indicated that campus residence, citizenship, college, and ethnicity had significant impacts on persistence. Frequency significance levels for the variables were campus residence $p < 0.001$, ethnicity $p < 0.02$, citizenship $p < 0.05$, and college $p < 0.02$. Both the linear correlation test and the frequency test disclosed that campus residence had the strongest impact on persistence. Approximately 68% of first-time freshmen live on campus each year. When compared to students living on campus, total first-time freshmen persistence rates over a five-year period showed the same trend as that of students living on campus (Figure 1).

Table1. Correlations Between Categorical Variables and First-Year Persistence

Categorical Variables	First-Year Persistence
Campus Residence	0.1271**
State Residency	-0.0169
Citizenship	-0.0135
Ethnicity	0.0089
College	-0.0163
Gender	-0.0076

** $p < 0.01$

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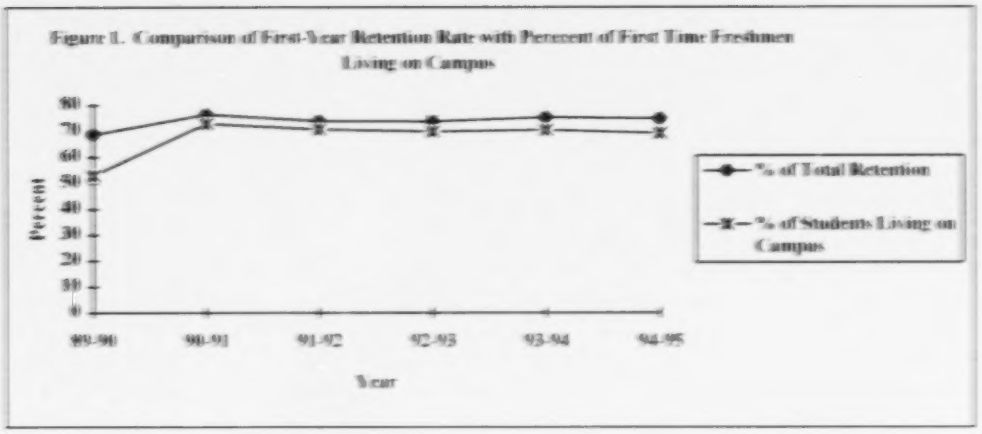

To test the accuracy of the model, linear regression was applied to regress campus resident students' first-year persistence for both scales of percent and number over a five-year period from Fall 1989 to Fall 1993 (Table 2). Both forecast equations were statistically significant at the 0.01 level (Table 3). However, the results of predicting the first-year persistence of Fall 1994 indicated that although both models have the same significance level, their accuracy of forecast was different. The forecast accuracy for the percentage model was 0.56% showing a difference of two between actual and forecasted enrollment (Table 4) and for the number model was 3.42% showing a difference of seventeen between the actual and forecasted enrollment (Table 5).

Table 2. Models forecasting Fall 1994 First-time Freshmen's First -Year Persistence Rate and Numbers of Persistence Students

First-Year Persistence Rate (%) of First-Time Freshmen = 49.7693 + (0.3539) * (RAP)

Number of First-year Retained First-time Freshmen = 97.0175 + (0.7494) * (RAN)

RAP = Percent of First-Time Freshmen Living on Campus
RAN = Number of First-Time Freshmen Living on Campus

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Table 3. Linear Regression Analysis of First-year Persistence for Both Scales of Percent and Number from Fall 1989 to Fall 1993.

Scale	Predictor	R-Square	F	p
Percent of Student	Percent of Students Living On Campus	0.93	40.11	0.008
Number of Student	Number of Students Living On Campus	0.92	32.20	0.010

Table 4. Results of Forecasting Fall 1994 Persistence Rates and Numbers for the Model with the Scale of Percentage of Total

Terms	Persistence Rate of 1993-95	Persistence Headcount of 1993-95
Actual	74.85%	372
Forecast	74.29%	370
(Actual - Forecast)	0.56%	2

Table 5. Results of Forecasting Fall 1994 Retention Rates and Numbers for the Model with the Scale of Student Counts

Terms	Retention Rate of 1993-95	Retention Headcount of 1993-95
Actual	74.85%	372
Forecast	71.43%	355
(Actual - Forecast)	3.42%	17

The difference of the accuracy measurements between the two models can be explained by the variation within the samples. Based on the confidence interval tests, data of the model using number count had a wider range of confidence interval than the data of the model using percentages. Trend analysis along with other multiple comparison methods are robust to departures from normality but are not as robust to large departures from homogeneity of variance (Glass and Hopkins, 1984). The wider variance caused the number model to accept a higher level of forecasting error than the percentage model.

Limitations

Persistence is affected by numerous variables that can be student or institutional dependent. Therefore, variables that affect students at one institution may not be the same variables affecting students at other

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institutions. The results of this study cannot be generalized and are most applicable only to institutions of the same mission, size, type of student body, and percent of students living on campus.

Conclusions

The conclusions of the study are three-fold. First, trend analysis is an effective method to discover the temporal relationship between students' retention and categorical factors. Second, the discovery from trend analysis can be used in creating a forecasting model. Finally, the scale of variables used in the formation for the forecasting model affects the forecast accuracy.

The methodology of combining trend analysis and significant persistence variables warrants attention as it provides institutional researchers with a potentially more accurate means to predict continuous enrollment. Through determination of significant variables affecting the persistence of different classes of students and the temporal relationships, researchers may be able to better assist educational planners to meet the needs of all students.

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